

(51) 6-0-02-11-48

(12) ОПИСАНИЕ ИЗОБРЕТЕНИЯ  
к патенту Российской Федерации

6.2) 0.0003.06

(2) Ибрагимов А.Н., Крисанов О.А., Мельников А.В., Петренко С.В., Сорокина Л.Е., Фролов А.А., Шубин В.С.

[illegible]

1590. Т. SU. Западное направление. 1982. 2. FU. Patent.  
1983/80. К. 02 F 1 48. 1982. 2. FU. Patent.  
1983/80. К. 02 F 1 62. 1984. 2.

654) ЧИСТОБ. ОУЧЕНИКИ ВОШЛИ ВЪ ТУ:  
505, ПОНОС. МЕД. 505 И ОРИЕНТИ-  
СКИХЪ СОВЕТНИКОВЪ

550) The experimental results demonstrate that the structure of the polymer is important in determining the rate of polymerization. The results also indicate that the rate of polymerization is dependent on the concentration of the monomer and the concentration of the catalyst.

составляющих, представляющих собой производные от элементарных функций, а также от элементарных функций, образованных из элементарных функций с помощью операций сложения, умножения, деления, возведения в степень, извлечения корня, логарифмирования, экспонентирования, дифференцирования, интегрирования, и т.д. В частности, к элементарным функциям относятся функции, заданные формулами, содержащими только элементарные функции и операции сложения, умножения, деления, возведения в степень, извлечения корня, логарифмирования, экспонентирования, дифференцирования, интегрирования, и т.д. В частности, к элементарным функциям относятся функции, заданные формулами, содержащими только элементарные функции и операции сложения, умножения, деления, возведения в степень, извлечения корня, логарифмирования, экспонентирования, дифференцирования, интегрирования, и т.д.

RU 210255 / C



2102337 (1



Хорошо известно, что при обработке металлов резанием в зоне резания происходит образование большого количества тепла, которое приводит к быстрому нагреву обрабатываемого материала. Вследствие этого происходит изменение структуры и свойств обрабатываемого материала, что приводит к снижению его прочности и долговечности.

В настоящее время широко применяются различные методы охлаждения и смазки при обработке металлов резанием. Однако эти методы не всегда обеспечивают необходимое охлаждение и смазку в зоне резания, что приводит к снижению качества обработки.

В предлагаемом изобретении предлагается использовать для охлаждения и смазки при обработке металлов резанием жидкий кристаллический материал, который обладает высокой теплопроводностью и смазочными свойствами.

### ФОРМУЛА ИЗОБРЕТЕНИЯ

Изобретение относится к области обработки металлов резанием, а именно к способу охлаждения и смазки при обработке металлов резанием. Сущность изобретения заключается в том, что при обработке металлов резанием в зону резания подается жидкий кристаллический материал, который обладает высокой теплопроводностью и смазочными свойствами.

Известно, что при обработке металлов резанием в зоне резания происходит образование большого количества тепла, которое приводит к быстрому нагреву обрабатываемого материала. Вследствие этого происходит изменение структуры и свойств обрабатываемого материала, что приводит к снижению его прочности и долговечности.

В предлагаемом изобретении предлагается использовать для охлаждения и смазки при обработке металлов резанием жидкий кристаллический материал, который обладает высокой теплопроводностью и смазочными свойствами.

Таблица 1

Образец	Исходные концентрации металлов в воде мг/л		Кол-во Al мг/л	Остаточные концентрации загрязнений мг/л	
	Cu	Co		Cu	Co
1	100	500	20	0,70	0,80
2	100	500	30	0,70	0,80
3	100	500	60	0,03	0,10
4	100	500	150	0,00	0,10
5	100	500	250	0,00	0,10
6	100	500	250	0,00	0,00

Таблица 2

Образец	Исходная концентрация Cu в воде мг/л	Введенная в топливную энергия в вт	Кол-во Al мг/л	Остаточная концентрация загрязнения мг/л
1	100	0,4	100	0,47
2	100	0,5	100	0,33
3	100	0,6	100	0,42
4	100	1,1	100	0,11
5	100	1,2	100	0,20
6	100	1,4	100	0,00

Таблица 3

Образец	Исходные концентрации хлориста в воде мг/л	Кол-во Al мг/л	Остаточная концентрация хлориста в воде мг/л
1	12	20	8,7
2	12	30	4,7
3	12	60	0,04
4	12	150	0,01
5	12	250	0,01
6	12	250	0,01

Таблица 4

Образец	Исходная концентрация нитробензола в воде мг/л	Кол-во Al мг/л	Остаточная концентрация нитробензола мг/л
1	10,0	20	8,0
2	10,0	30	4,0
3	10,0	60	0,00
4	10,0	150	0,00
5	10,0	250	0,00
6	10,0	250	0,00

Заказ № \_\_\_\_\_ Подписное \_\_\_\_\_  
ВНИИИИИ. Рег. № 040720  
113834, Г.П. Москва, Рязанская наб., д. 5  
Т. 1873, М. Москва, Варшавская наб., д. 24 стр. 2.  
Почтовый индекс 113834. Телефон 4000. Факс 4000

[seal] (19) RU (11) 2,102,337 (13) C1  
(51) 6 C 02 F 1/48

Committee of the Russian Federation  
on Patents and Trademarks

(12) **DESCRIPTION OF THE INVENTION**  
for Patent of the Russian Federation

(21) 96104571/25 (22) March 6, 1996

(46) June 20, 1998 Bull. No. 2

(72) Il'in A. P., Krasnyatov Yu. A., Maksimenko B. V., Nazarenko O. B., Sirotkina Ye. Ye., Fedushak T. A., Shubin B. G.

(71)(73) Scientific Research Institute of High Voltages at the Tomsk Politechnical Institute.

(56) 1. SU, Inventor's Certificate 960,130, cl. C 02 F 1/48, 1982. 2. RU, Patent, 2,013,380, cl. C 02 F 1/62, 1994.

(54) **MEANS OF REMOVING GASES, METAL IONS, AND ORGANIC COMPOUNDS FROM WATER**

(57) The invention relates to a means of removing gases, metal ions, and organic compounds from water and it may be used in various branches of industry to purify wastewater at production plants, etc. This means makes it possible to increase the effectiveness with which water is purified of metal ions, organic compounds, and gases and to reduce the cost of removing impurities from water. The essence of the invention is that water is treated with ultradispersed metal powders obtained by electrically exploding conductors of these metals and removing the residue. The conductors are placed directly in the

water that is to be purified or above the water or in an air-water mixture and then exploded. The ratio of energy applied to the conductors to the sublimation energy of the conductor material is 0.6 to 1.1 and the mass of the exploded conductor is 50 to 150 mg per 1 liter water being purified. 4 tables.

The invention relates to means of removing gases, metal ions, and organic compounds from water and it may be used in various branches of industry to purify wastewater at production plants, etc.

A device is known for purifying water by electrical discharges, comprising a high-voltage pulse generator, an air discharger, a processing chamber with an electrode system, and a tank for the water being purified, equipped with a unit for pumping out ozone from the discharger, placed between the discharger and the tank for the water that is being purified [1].

The problem with this device is its inefficiency in purifying water of heavy metal impurities and many organic compounds.  $\text{C}^{6+}$ ,  $\text{Ni}^{2+}$ ,  $\text{Cu}^{2+}$ , and other metals are unaffected by ozone as, for example, chlorinated aromatic compounds. To the contrary, treating nitrogen dioxide in an electrical discharge forms nitrites and nitrates and reduces the pH of the medium, which increases the solubility of many compounds.

The means that is most similar in technical essence to the proposed method is the means for removing metal ions from wastewater in reference [2]. In accordance with this method, effluent water is treated with a metal-containing agent, followed by separation of the residue, whereby the metal-containing reagent is an ultradispersed powder (UDP) of aluminum and/or iron, obtained by the electrical explosion of a conductor in a protective gas environment in an amount of 200 to 500 mg/liter.

The problem with this method is that the purification process takes a long



time because of the low activity of ultradispersed powders, due to their production in a chemically inert gaseous environment and the subsequent passivation of the UDP in air. They are cooled in the process and part of the substance is converted to oxides or hydroxides (up to 15% by mass).

The main technical object of our proposed solution is to increase the effectiveness with which water is purified of metal ions, organic compounds, and gases. Compared to the prototype [prior art], the consumption of reagent is reduced by 25% or more. Moreover, the proposed means does not require passivation, packaging, or storage of the ultradispersed powders, which reduces the expense of removing impurities from water, as compared to the prior art.

This object is achieved in that, while removing gases, metal ions, and organic substances from water, including treatment of the water with ultradispersed metal powders prepared by electrical explosion of conductors made of these metals and separation of the residue, in accordance with this invention the conductors are placed before the explosion directly in the water or above the water or in an air-water mixture, after which the conductor is exploded. The ratio of energy applied to the conductors to the sublimation energy of the conductor material is 0.6 to 1.1 and the mass of the exploded conductor is 50 to 150 mg per 1 liter water being purified.

Specific examples.

Example 1. 1 liter of a simulated aqueous solution containing chromium ions at a concentration of 1 mg/liter and copper at 5 mg/liter was added to a

discharge chamber. A small aluminum wire was placed in the solution undergoing purification and it was dispersed by a strong pulsed current in such a way that the ratio of energy applied to the conductor to the sublimation energy of the conductor material was 0.9. The total mass of the exploded aluminum conductor was 100 mg/liter. The powder that was formed was oxidized at the same time as the electrical explosion. The residue was then removed by settling. The residual quantity of chromium ions in the water was determined by photocalorimetry.

As seen in Table 1, when the water is treated, it is practically completely purified of metal ions when over 50 mg aluminum is added. If less than 50 mg/liter aluminum is added, then the water is insufficiently purified and the metal ions exceed the MPC. No more than 150 mg/liter aluminum should be added, since the water is purified even when just 50 mg/liter is added. Thus, the optimum amount is 50 to 150 mg of aluminum per liter.

As indicated above, water was purified of chromium ions by using an electrical explosion of an aluminum conductor, while varying the amount of energy applied to the conductor. The results from these experiments are presented in Table 2.

As seen in Table 2, when the water is treated, the impurities are almost completely removed at  $e/e_s \geq 0.6$ , but  $\leq 1.1$ . At  $e/e_s < 0.6$ , the electrical energy applied to the conductor is insufficient to achieve a high degree of dispersion and activity in the explosion product, while at  $e/e_s > 1.1$ , the products of the explosion

are highly active and interact primarily with the water rather than with the impurities. Thus, the optimum value for the applied energy is  $e/e_s = 0.6$  to  $1.1$ .

Example 2. Water containing dissolved oxygen in an amount of 12 mg/liter was treated. The oxygen content was determined by iodometry. The water was treated as in Example 1.

As seen in Table 3, when the water is treated, the oxygen is almost completely removed if over 59 mg/liter aluminum is added. No more than 150 mg/liter should be used, since purification has already been achieved.

Example 3. Water containing 25 mg/liter nitrobenzene was purified. The initial concentration before the water was treated and the concentration afterward were determined by liquid chromatography.

The water was treated as in Example 1. The results from these experiments are presented in Table 4.

As seen in Table 4, when the water is treated, the nitrobenzene is almost completely removed if 50 mg/liter aluminum or more is added. No more than 150 mg/liter of reagent should be used, since purification has already been achieved.

Similar results were obtained when water was treated that contained - chloronaphthalene, chlorobenzene, and benzyl chloride, and when another reagent, ultradispersed iron, was used instead of ultradispersed aluminum.

**FORMULA OF THE INVENTION [CLAIM]**

A means of removing gases, metal ions, and organic compounds from water, including treatment of the water with ultradispersed metal powders obtained by electrical explosion of conductors made of these metals and separation of the residue, wherein, before the explosion, the conductors are placed directly in or over the water that is to be purified or in an air-water mixture, after which the conductor is exploded, whereby the ratio of energy applied to the conductors to the sublimation energy of the conductor material is 0.6 to 1.1 and the mass of the exploded conductor is 50 to 150 mg per 1 liter of water being purified.

Table. 1

Sample	Initial concentration of metals in water, mg/liter		Quantity of Al, mg/liter	Residual concentration of contaminants, mg/liter	
	Cr	Cu		Cr	Cu
1	1.00	5.00	20	0.70	0.90
2	1.00	5.00	30	0.20	0.60
3	1.00	5.00	50	0.03	0.05
4	1.00	5.00	150	0.00	0.00
5	1.00	5.00	200	0.00	0.00
6	1.00	5.00	250	0.00	0.00

Table 2.

Sample	Initial concentration of Cr in water, mg/liter	Energy applied to conductor, e/e <sub>s</sub>	Quantity of Al, mg/liter	Residual concentration of contaminants, mg/liter
1	1.00	0.4	100	0.42
2	1.00	0.5	100	0.33
3	1.00	0.6	100	0.02
4	1.00	1.1	100	0.02
5	1.00	1.2	100	0.26
6	1.00	1.4	100	0.68

Table 3:

Sample	Initial concentration of oxygen in water, mg/liter	Quantity of Al, mg/liter	Residual concentration of oxygen, mg/liter
1	12	20	6.7
2	12	30	1.1
3	12	50	0.04
4	12	150	0.00
5	12	200	0.00
6	12	250	0.00

Table 4.

Sample	Initial concentration of nitrobenzene in water, mg/liter	Quantity of Al, mg/liter	Residual concentration of nitrobenzene, mg/liter
1	10.0	20	6.0
2	10.0	30	4.0
3	10.0	50	0.70
4	10.0	150	0.00
5	10.0	200	0.00
6	10.0	250	0.00

[Printing information is given at the bottom of the page—Trans. note.]